What is claimed is:

Sub B1

1. A color image segmentation method for segmenting a color image into a plurality of regions, comprising the steps of :

(a) calculating a first value representing a degree of difference between a pixel and peripheral pixels from the color of peripheral pixels based on a plurality of pixel values of an input image;

(b) obtaining a converted image by converting the first value into a value of a predetermined scale; and

(c) segmenting the converted image.

2. The color image segmentation method according to claim 1, wherein the step (c) segments the converted image based on a region growing method.

3. The color image segmentation method according to at least one of claim 1 or claim 2, wherein prior to the step (a), said method further comprises the step of (p-a) quantizing pixel values of the input image into a predetermined number of representative quanatized pixel values.

4. The color image segmentation method according to claim 3, wherein the representative pixel values consist of 10-20 values.

5. The color image segmentation method according to claim 1 or claim 2, wherein prior to the step (a), said method further comprises the steps of:

(p-a-1) defining a window containing a center pixel; and

wherein said step (a) further comprises calculating a second value representing the degree of difference between a pixel and peripheral pixels from the color of peripheral pixels with respect to pixels in the defined window.

6. The color image segmentation method according to claim 3, wherein prior to the step (a), said method further comprises the steps of:

(p-a-1) defining a window containing a center pixel; and

wherein said step (a) further comprises calculating a second value representing the degree of difference between a pixel and peripheral pixels from the color of peripheral pixels with respect to pixels in the defined window.

7. The color image segmentation method according to claim 1 or claim 2, wherein the step (a) comprises the steps of:

(a-1) defining a window which is centered at a pixel p and has a size of d x d when d is a positive integer, said window having a set of pixels Z; and

(a-2) classifying a pixel position of each pixel of set Z into one of a C number of classes when i is a number between 1 and C; and

(a-3) obtaining a J-value, as said first value, with respect to each pixel in a class-map as:

$$J = \frac{S_B}{S_W} = \frac{S_T - S_W}{S_W}$$

where m_i is an average of positions of Ni data points in class Z_i, i=1 to C, and

$$S_T = \sum_{z \in Z} \|z - m\|^2 \text{ and } S_W \sum_{i=1}^{C} S_i = \sum_{i=1}^{C} \sum_{z \in Z_i} \|z - m_i\|^2$$

8. The color image segmentation method according to claim 3, wherein the step (a) comprises the steps of:

(a-1) defining a window which is centered at a pixel p and has a size of d x d when d is a positive integer, said window having a set of pixels Z; and

(a-2) classifying a pixel position of each pixel of set Z into one of a C number of classes when i is a number between 1 and C; and

(a-3) obtaining a J-value, as said first value, with respect to each pixel in a class-map as:

$$J = \frac{S_B}{S_W} = \frac{S_T - S_W}{S_W}$$

where m_i is an average of positions of N_i data points in class Z_i, i=1 to C, and

$$S_T = \sum_{z \in Z} \left\| z - m \right\|^2 \text{ and } S_W = \sum_{i=1}^{C} S_i = \sum_{i=1}^{C} \sum_{z \in Zi} \left\| z - m_i \right\|^2$$

9. The color image segmentation method according to claim 4, wherein the step (a) comprises the steps of:

(a-1) defining a window which is centered at a pixel p and has a size of d x d when d is a positive integer, said window having a set of pixels Z; and

(a-2) classifying a pixel position of each pixel of set Z into one of a C number of classes when i is a number between 1 and C, and

(a-3) obtaining a J-value, as said first value, with respect to each pixel in a class-map as:

$$J = \frac{S_B}{S_W} = \frac{S_T - S_W}{S_W}$$

where m_i is an average of positions of N_i data points in class Z_i, i=1 to C, and

$$S_T = \sum_{z \in Z} \left\| z - m \right\|^2 \text{ and } S_W = \sum_{i=1}^{C} S_i = \sum_{i=1}^{C} \sum_{z \in Z_i} \left\| z - m_i \right\|^2$$

10. The color image segmentation method according to claim 5, wherein in said step (p-a-1), said window has a size of d x d when d is a positive integer, said window having a set of pixels Z, and the step (a) comprises the steps of:

(a-1) classifying a pixel position of each pixel of set Z into one of a C number of classes when i is a number between 1 and C, and

(a-2) obtaining a J-value, as said first value, with respect to each pixel in a class-map as:

$$J = \frac{S_B}{S_W} = \frac{S_T - S_W}{S_W}$$

where m_i as said second value is an average of positions of Ni data points in class Z_i, i=1 to C, and

$$S_T = \sum_{z \in Z} \left\| z - m \right\|^2 \text{ and } S_W = \sum_{i=1}^{C} S_i = \sum_{i=1}^{C} \sum_{z \in Z_i} \left\| z - m_i \right\|^2$$

11. The color image segmentation method according to claim 6, wherein in said step (p-a-1), said window has a size of d x d when d is a positive integer, said window having a set of pixels Z, and the step (a) comprises the steps of:

(a-1) classifying a pixel position of each pixel of set Z into one of a C number of classes when i is a number between 1 and C, and

(a-2) obtaining a J-value, as said first value, with respect to each pixel in a class-map as:

$$J = \frac{S_B}{S_W} = \frac{S_T - S_W}{S_W}$$

where m_i as said second value, is an average of positions of N_i data points in class Z_i, i=1 to C, and

$$S_T = \sum_{z \in Z} \left\| z - m \right\|^2 \text{ and } S_W = \sum_{i=1}^{C} S_i = \sum_{i=1}^{C} \sum_{z \in Z_i} \left\| z - m_i \right\|^2$$

12. The color image segmentation method according to claim 7, wherein d is an integer inclusive of and between 3 and 10.

13. The color image segmentation method according to claim 8, wherein d is an integer inclusive of and between 3 and 10.

14. The color image segmentation method according to claim 9, wherein d is an integer inclusive of and between 3 and 10.

15. The color image segmentation method according to claim 10, wherein d is an integer inclusive of and between 3 and 10.

16. The color image segmentation method according to claim 11, wherein d is an integer inclusive of and between 3 and 10.

17. The color image segmentation method according to at least one of claim 1 or claim 2, wherein the predetermined scale is a gray scale having values between 0 and 255.

18. The color image segmentation method according to claim 3, wherein the predetermined scale is a gray scale having values between 0 and 255.

19. The color image segmentation method according to claim 4, wherein the predetermined scale is a gray scale having values between 0 and 255.

20. The color image segmentation method according to claim 5, wherein the predetermined scale is a gray scale having values between 0 and 255.

21. The color image segmentation method according to claim 6, wherein the predetermined scale is a gray scale having values between 0 and 255.

22. The color image segmentation method according to claim 7, wherein the predetermined scale is a gray scale having values between 0 and 255.

23. The color image segmentation method according to claim 8, wherein the predetermined scale is a gray scale having values between 0 and 255.

24. The color image segmentation method according to claim 9, wherein the predetermined scale is a gray scale having values between 0 and 255.

25. The color image segmentation method according to claim 10, wherein the predetermined scale is a gray scale having values between 0 and 255.

26. The color image segmentation method according to claim 11, wherein the predetermined scale is a gray scale having values between 0 and 255.

27. The color image segmentation method according to claim 12, wherein the predetermined scale is a gray scale having values between 0 and 255.

28. The color image segmentation method according to claim 13, wherein the predetermined scale is a gray scale having values between 0 and 255.

29. The color image segmentation method according to claim 14, wherein the predetermined scale is a gray scale having values between 0 and 255.

30. The color image segmentation method according to claim 15, wherein the predetermined scale is a gray scale having values between 0 and 255.

31. The color image segmentation method according to claim 16, wherein the predetermined scale is a gray scale having values between 0 and 255.

32. An object-based color image processing method for processing a color image according to a color image segmentation method, wherein the color image segmentation method comprises the steps of:

(a) calculating a first value representing a degree of difference between a pixel and peripheral pixels from the color of peripheral pixels based on a plurality of pixel values of an input image;

(b) obtaining a converted image by converting said first value into a value of a predetermined scale; and

(c) segmenting the converted image.

33. The color image processing method according to claim 32, wherein the color image processing method complies with the MPEG-7 standard.

34. A color image segmentation method for segmenting a color image into a plurality of regions, comprising the steps of:

(a) quantizing pixel values of an image into a number of representative pixel values;

(b) calculating a first value representing a degree of difference between a pixel and peripheral pixels from the color of pixels in a predetermined size window using quantized representative pixel values;

(c) obtaining a converted image by converting said first value into a value of a predetermined scale; and

(d) segmenting the converted image using a segmentation method based on a region growing method.

35. The color image segmentation method according to claim 34, wherein the step (b) comprises the steps of:

(b-1) defining a window B which is centered at a pixel p and has a size of d x d when d is a positive integer, said window having a set of pixels Z; and

(b-2) classifying a pixel position of each pixel of set Z into one of a C number of classes when i is a number between 1 and C, and

(b-3) obtaining a J-value as said first value with respect to each pixel in a class-map as:

$$J = \frac{S_B}{S_W} = \frac{S_T - S_W}{S_W}$$

where m_i is the average of positions of N_i data points in class Z_i, i=1 to C, and

$$S_T = \sum_{z \in Z} \left\| z - m \right\|^2 \text{ and } S_W = \sum_{i=1}^{C} S_i = \sum_{i=1}^{C} \sum_{z \in Z_i} \left\| z - m_i \right\|^2$$

36. The color image segmentation method according to claim 35, wherein d is an integer inclusive of between 3 and 10.

37. The color image segmentation method according to one of claim 34 to claim 36, wherein the predetermined scale is a gray scale having values between 0 and 255.

38. A medium for storing program codes performing a color image segmentation method for segmenting a color image into a plurality of regions, wherein the medium comprises computer readable code means for:

(a) quantizing pixel values of an image into a number of representative pixel values;

(b) calculating a first value representing a degree of difference between a pixel and peripheral pixels from the color of pixels in a predetermined size window using quantized representative pixel values;

(c) obtaining a converted image by converting said first value into a value of a predetermined scale; and

(d) segmenting the converted image using a segmentation method based on a region growing method.

39. The medium according to claim 38, wherein means (b) comprises computer readable code means for:

(b-1) defining a window which is centered at a pixel p and has a size of d x d when d is a positive integer and Z is a set of all pixels in said window; and

(b-2) classifying each pixel position of the set of pixels Z into one of a C number of classes when i is a number between 1 and C, and

(b-3) obtaining a J-value, as said first value, with respect to each pixel in a class-map as:

$$J = \frac{S_B}{S_W} = \frac{S_T - S_W}{S_W}$$

where m_i is the average of positions of N_i data points in class Z_i, i=1 to C, and

$$S_T = \sum_{z \in Z} \left\| z - m \right\|^2 \text{ and } S_W = \sum_{i=1}^{C} S_i = \sum_{i=1}^{C} \sum_{z \in Z_i} \left\| z - m_i \right\|^2$$

40. The medium according to claim 39, wherein d is set as an integer inclusive of and between 3 and 10.

41. The medium according to one of claim 38 to claim 40, wherein the predetermined scale is a gray scale having values between 0 and 255.

42. The method according to claim 7 further comprising:

(d) checking for effectiveness of segmentation of step (c) according to a result of

$$\overline{J} = \frac{1}{N}\sum_{k} M_k J_k$$

where J_k is the J value of a region k,

M_k is a number of pixel points in region k, and

N is a total number of pixel points in the window.

43. The medium of claim 38 further comprising a computer readable means for:

(e) checking for effectiveness of segmentation of provided by means (d) according a result

$$\overline{J} = \frac{1}{N}\sum_{k} M_k J_k$$

where J_k is the J value of a region k,

M_k is a number of pixel points in region k, and

N is a total number of pixel points in the window.

44. The color image segmentation method according to claim 4, wherein prior to the step (a), said method further comprises the steps of:

(p-a-1) defining a window containing a center pixel; and

wherein said step (a) further comprises calculating a second value representing the degree of difference between a pixel and peripheral pixels from the color of peripheral pixels with respect to pixels in the defined window.

45. The color image segmentation method according to claim 44, wherein in said step (p-a-1), said window has a size of d x d when d is a positive integer, said window having a set of pixels Z, and the step (a) comprises the steps of:

(a-1) classifying a pixel position of each pixel of set Z into one of a C number of classes when i is a number between 1 and C, and

(a-2) obtaining a J-value, as said first value, with respect to each pixel in a class-map as:

$$J = \frac{S_B}{S_W} = \frac{S_T - S_W}{S_W}$$

where m_i as said second value is an average of positions of Ni data points in class Z_i, i=1 to C, and

$$S_T = \sum_{z \in Z} \left\| z - m \right\|^2 \text{ and } S_W = \sum_{i=1}^{C} S_i = \sum_{i=1}^{C} \sum_{z \in Z_i} \left\| z - m_i \right\|^2 .$$

46. The color image segmentation method according to claim 45, wherein d is an integer inclusive of and between 3 and 10.

47. The color image segmentation method according to claim 44, wherein the predetermined scale is a gray scale having values between 0 and 255.

48. The color image segmentation method according to claim 45, wherein the predetermined scale is a gray scale having values between 0 and 255.

49. The color image segmentation method according to claim 46, wherein the predetermined scale is a gray scale having values between 0 and 255.